OUNTER-TIMER

Global 5001 Universal
Counter - Timer

ALLIED COMMUNICATIONS
EQUIPMENT SUPPLY CO., INC.

P.O. BOX 395
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Phone: (712) 322-2725

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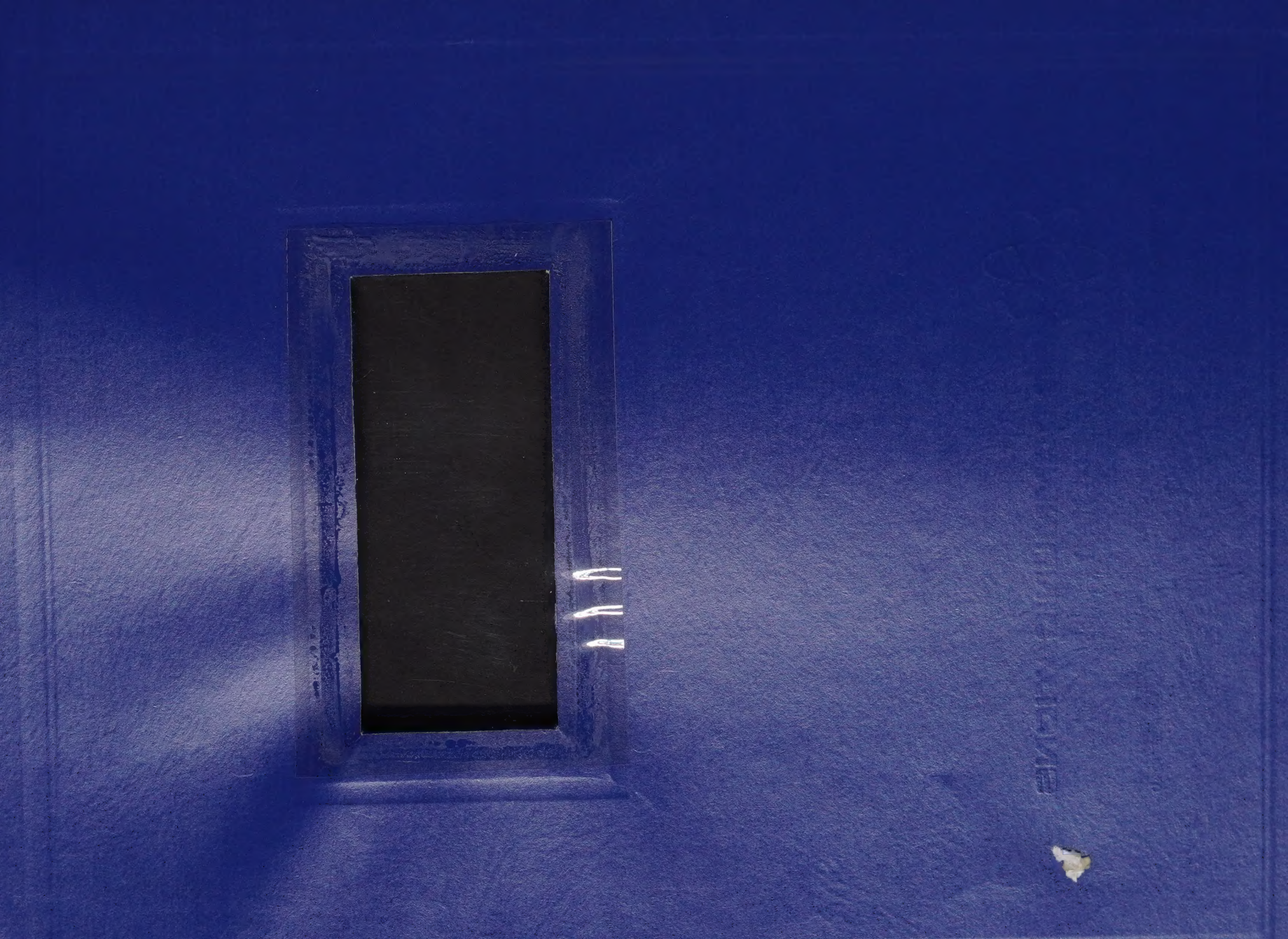

5001 UNIVERSAL COUNTER-TIMER

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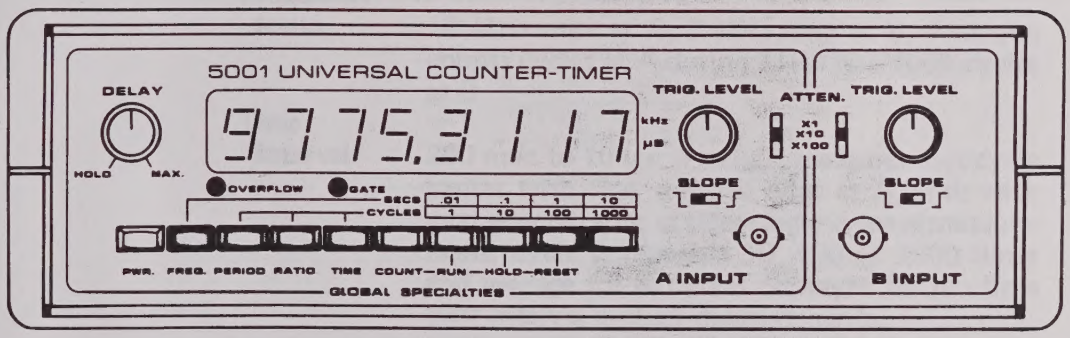

INSTRUCTION, OPERATION and APPLICATION MANUAL

80-01-0037
5/86

GLOBAL SPECIALTIES
An Interplex Electronics Company
70 Fulton Terrace, P.O. Box 1942
New Haven, Connecticut 06509
(203) 624-3103 • TWX 710 465-1227

Global Tool Universal
Counter - Timer

5001 SPECIFICATIONS

INPUTS: 2 inputs, A and B, DC coupled, BNC connector

Impedance	1 MegOhm + 25 pF
Response	10 MHz max at A, 2 MHz max at B
Sensitivity	20 mV_{RMS} R
Controls	x1/x10/x100 Attenuators, Slope Select, variable Trigger Level

REFERENCE: 10 MHz crystal oscillator, ±4 ppm from 5-35°C

MODES:

Frequency	10 MHz max, 4 ranges with gate times of .01/0.1/1.0/10 secs, display in KHz, A input only
Period	400 nsec to 10 sec, 4 ranges with 1/10/10/1000 cycle average, display in microseconds, A input only
Frequency Ratio	10 MHz max at A, 2 MHz max at B, 4 ranges, counts cycles at A during 1/10/100/1000 cycles at B
Time Interval	200 nsec to 10 sec, 4 ranges, measurement cycle begins with first selected edge at A, ends with next selected edge at B for single interval measurement; cycle is repeated 10, 100 or 1000 times and average for all cycles displayed for multiple time interval average measurements.
Unit Count	max count 10^8, max freq 10 MHz, A input only, 1 range, *Run* button starts and displays running count, or returns display to running count. *Hold* button freezes display while running count continues, *Reset* button resets count to zero

CONTROLS: *Power,* 5 *Mode* selector switches, 4 *Range* selector switches, *Run, Hold, Reset, Display Delay,* plus *Trigger Level, Slope Select* and *Attenuator* in both A and B input channels

DISPLAY: 8-digit 7-segment 0.43-inch LED display, decimal point indicates time in microseconds, frequency in KHz; discrete LEDs indicate *Overflow* (counter overflow) and *Gate* (gate open); *Delay* feature varies period between measurement cycles from 75 msec to 7.5 sec with *Delay* control, detent position holds next measurement reading indefinitely

POWER: 105-135 VAC, 57-63 Hz, 10 VA maximum (215-250 VAC, 50-60 Hz version available)

DIMENSIONS: 3x10x7 inches H x W x D (76x254x178 mm) 3.0 lbs. (1.4kg)

OP TEMP: 0-50°C, calibrated at 25°C±5%

INCLUDES: Instruction manual

ADDENDUM

5001 UNIVERSAL COUNTER-TIMER with External Timebase

This Addendum updates the existing 5001 operating instructions maintenance procedures, applications and specifications to include the new external timebase capability.

Rev. 2/84

80-01-0037

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5001 SPECIFICATIONS

INPUTS: 2 inputs, A and B, DC coupled, BNC connector

Front Panel:
- Impedance: 1 MegOhm + 25pF
- Response: 10 MHz max at A, 2 MHz max at B
- Sensitivity: 20 mv RMSR
- Controls: x1/x10/x100 Attenuators, Slope Select, variable Trigger Level

Rear Panel: External Timebase input, DC coupled, BNC connector,
- Impedance: 1 Meg (1K above +5V or below 0V input)
- Input Requirements: Pulses (50 ns min, width) or sine wave, +1 volt to + 3.5v min, -15 v to +20 v maximum, 100 kHZ to 10 MHZ.

REFERENCE: 10 MHz crystal oscillator, ±4 ppm from 5-35°C or external timebase

MODES:

- **Frequency:** 10 MHz max, 4 ranges with gate times of 0.01/0.1/1.0/10 secs., display in kHz, A input only.
- **Period:** 400 nsec to 10 sec, 4 ranges with 1/10/10/1000 cycle average, display in microseconds, A input only.
- **Frequency Ratio:** 10 MHz max at A, 2 MHz max at B, 4 ranges, counts cycles at A during 1/10/100/1000 cycles at B.
- **Time Interval:** Up to 10 sec, 4 ranges, measurement cycle begins with first selected edge at A, ends with next selected edge at B for single interval measurement; cycle is repeated 10, 100 or 1000 times and average for all cycles displayed for multiple time interval average measurements.

ACCURACY:

- **Frequency:** LSD displayed - 0.1 Hz, 1Hz, 10Hz, 100 Hz switch selectable. Accuracy ± (timebase error x freq) ± trigger error ± 1 count.
- **Period:** LSD displayed - 0.1 ns, 1 ns, 10 ns, 100 ns switch selectable. Accuracy ± (timebase error x period) ± $\frac{\text{trigger error}}{N}$ x period) ± count; N=1, 10, 100, 1000
- **Pulse Width:** LSD displayed - 0.1 ms, 1ns, 10ns, 100ns, switch selectable; Accuracy ± START trigger error ± STOP trigger error ± (timebase error x pulse width) ± N counts; N=1, 10,100,1000

Note: Trigger error = $\frac{\text{peak-to-peak noise voltage on input}}{\text{signal slope (V/S)}}$

N=number of cycles or intervals averaged

Unit Count: max count 10^8, max freq 10 MHz, A input only, 1 range, Run button starts and displays running count, or returns display to running count. Hold button freezes display while running count continues, resets button resets count to zero.

CONTROLS: Power, 5 Mode selector switches, 4 Range selector switches, Run, Hold, Reset, Display Delay, plus Trigger Level, Slope Select and Attenuator in both A and B input channels, internal/external timebase switch.

DISPLAY: 8-digit 7-segment 0.43 inch LED display, decimal point indicates time in microseconds, frequency in kHz; discrete LED's indicate Overflow (counter overflow) and Gate (gate open); Delay feature varies period between measurement cycles from 75 msec to 7.5 sec with Delay control, detent position holds next measurement reading indefinitely.

POWER: 105-135 VAC, 57-63 Hz, 10 VA maximum (215-250 VAC, 50-60 Hz version available).

DIMENSIONS: 3x10x7 inches H x W x D (76x254x178 mm) 3.0 lbs. (1.4kg)

OP TEMP: 0-50°C, calibrated at 25°C ±5%

INCLUDES: Instruction manual

Add the following operating switch to the bottom of page 7:

INTERNAL/EXTERNAL TIMEBASE SWITCH (REAR PANEL)
Selects timebase used for counter operation. In the INTERNAL position, the internal 10 MHz timebase is used. In the EXTERNAL position, the user-provided signal applied to the EXTERNAL TIMEBASE INPUT BNC is used.

Add the following steps to Initial Inspection & Checkout Procedure, page 8. (Renumber remaining steps accordingly):

4. Connect the second signal source to the EXTERNAL timebase input BNC. Set its frequency to 1 MHz and its amplitude to 3VRMS. Select the .1 second gate time and the EXTERNAL timebase. The display should now indicate 10000.00 Note that the .1 second gate time now requires 1 second to take a reading.

5. Select the EXTERNAL timebase.

Delete Steps 5, 6 and 27 on Maintenance and Calibration Procedure, page 17:

Add the following steps to Maintenance & Calibration Procedure, page 17 (Renumber remaining steps accordingly):

5. Remove the four screws that secure the top and bottom case halves together (See Case disassembly) but do not remove the upper half at this time.

15a. Carefully remove the upper case half, as outlined under Case Disassembly, Step 6.

27. Carefully replace the upper case half as outlined under Case Reassembly, Step 2.

28. Wait one hour. If the display has not changed, continue to Step 29; if the display has changed, carefully remove the upper case half and return to Step 26.

Delete the 3rd paragraph, top of Page 20:

"Signals are then buffered by JFET.....

.....the use of current sources Q2 and Q4."

Add the following paragraph in place of deleted paragraph, page 20:

"Signals are then buffered, amplified, and level-shifted by high impedance compound series-feedback amplifiers 1 and 2 for the A input and 3 for the B input".

ADD THE FOLLOWING TEXT AT THE BOTTOM OF PAGE 13:

EXTERNAL TIMEBASE: SWITCHED BNC CONNECTOR

The external timebase input adds more flexibility to the 5001. It accepts pulses with 50 nsec minimum pulse widths and sine waves from 100 khZ to 10 MHz, with the following signal limits: maximum signal amplitude no less than +3.5v; minimum signal amplitude not greater than +1V. The external timebase input is protected for signals ranging from +20V to -15V. Input impedance is 1 Megohm from 0 to 5 v and 1 kohm outisde of this range. External timebase signals can therefore be provided by either CMOS, unloaded TTL, or any source meeting the minimum requirements. Using an external timebase, the 5001 can measure frequency with .01 Hz resolution: it can compare two high frequencies to display the frequency ratio; it can display events in units per sec. or units per minute; and it can measure and display time periods. Note that the display multiplexing frequency is a function of the oscillator frequency and display multiplexing will be noticeable with external oscillator frequencies below 500 khZ.

Refer to Applications Section for details and typical external timebase signals and gate settings.

Delete the following portion of paragraph 6, middle of page 21:

"A6 and A7 are cascaded to provide 5VDC.....

....this feeds the front end circuitry. R42 prevents ground loops possible through connection of the 5001 to other equipment."

Add the following in place of the deleted paragraph portion middle of page 21:

"A1 supplies +5 VDC to the input pre-amplifiers; A3 and A4 supply -10 VDC and +10 VDC respectively to Schmitt triggers U3 and U8; and A2 supplies +5 VDC to the logic circuitry".

Add the following text at the bottom of page 22 (above "Period Measurement")

Frequency Measurement with an External Timebase: To read frequency to 0.1 Hz resolution, a precision 1 MHz oscillator can be used as an external timebase. With the 10-second gate time selected, a 1 KHz signal applied to the A input would result in a display of 10.0000. Note that the decimal point position is unchanged from that observed with the internal 10 MHz oscillator. Consequently in this example, the decimal appears to be shifted to the right by one position. Also, gate times are directly affected by oscillator frequency. In the above example, the 10 second gate time position will result in an actual 100 second gate time. To interpret the display reading obtained with an external timebase oscillator (except 10 MHz), apply the following formula:

$$f = \frac{10}{\text{External Oscillator Frequency (MHz)}} \times \text{display reading}$$

Add the following text at the middle of page 23 (above "Time Measurement")

Period measurements are also flexible using an external oscillator frequency. Interpreting period readings is accomplished by the following formula, i.e.

$$\frac{\text{Ext. Osc. Freq. (in MHz)}}{10} \times \text{Display Reading} = \text{Period}$$

Add the following text in the middle of page 25 above "Event Counter"):

Frequency Ratio Measurement with an External Timebase:

To compare two high frequencies such as two oscillators running at a nominal 3.579545 MHz, use one of the oscillators as the external timebase and feed the other oscillator into the A input. With the .01 second gate time switch selected, a reading of 10000.0 would indicate an exact match. A reading of 9999.8 would indicate that the signal into the A input is .002% lower than the External Oscillator frequency, or 3.579473 MHz.

Add the following text at the bottom of page 25:

Event Counting with an External Timebase:

An external timebase can be used to display events in other than units per second. For example, if an external oscillator frequency of 166.667 KHz is applied, the display will be based on units per minute. To interpret any frequency reading obtained using other than a 10 MHz oscillator, use the following formula:

$$\frac{10}{\text{Ext. Osc. Freq.(in MHz)}} \times \text{display reading} = \text{Frequency}$$

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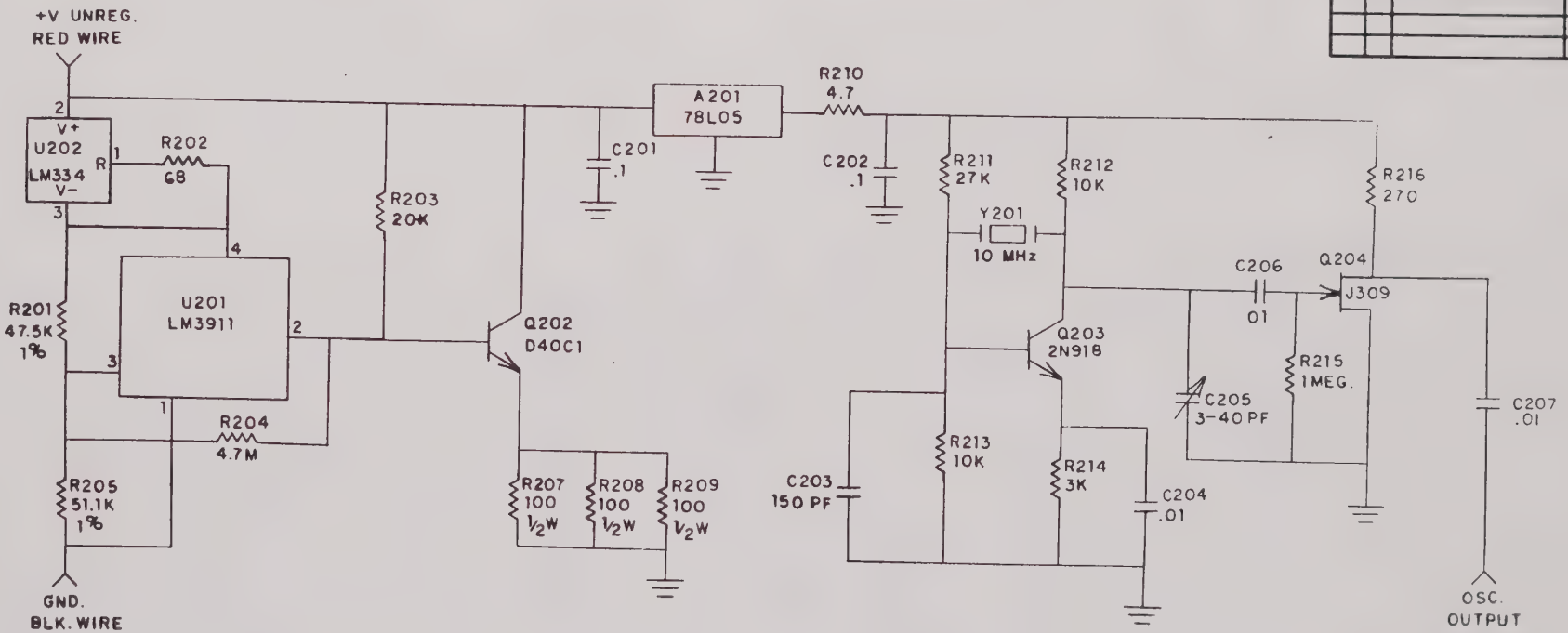

NOT USED
R206
Q201

NOTE
REFER TO 03-05-0042 FOR
5001-A SCHEMATIC.

TOLERANCES (EXCEPT AS NOTED)	Global Specialties Corporation		
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INTRODUCTION

The Model 5001 Universal Counter-Timer is designed for the electronic measurement and display of frequency, period, interval and counted events. It features full signal conditioning on both input channels, including attenuators, slope selection and variable trigger level. A unique variable delay hold circuit causes a 75 millisecond to 7.5 second delay between measurement cycles, during which time the results of the last measurement cycle remain displayed; a detent position on this control provides infinite delay, maintaining the results of one measurement cycle on the display indefinitely.

Measurement capabilities of the Model 5001 suggest broad applications in industry, laboratories, education, process control and production:

FREQUENCY. Measures to 10 MHz in four ranges. Selectable gate times of .01, 0.1, 1.0 or 10 seconds. Display indicates frequency at A input in KiloHertz.

PERIOD. Measures period of signal at A input, 400 nanoseconds to 10 seconds. Measures single cycle or averages over 10, 100 or 1000 cycles. Display indicates time in microseconds.

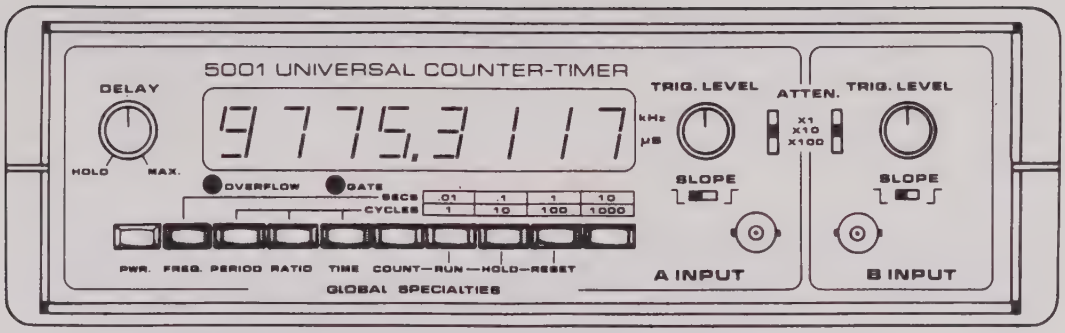
FREQUENCY RATIO. Counts number of cycles appearing at A input (to 10 MHz) during one cycle at B input (to 2 MHz), or averages this ratio over 10, 100 or 1000 cycles at B. Useful for scaling measurements, the display indicates the ratio F_A/F_B.

TIME INTERVAL. Measures time between selected signal edge appearing at A input (which starts the measurement) and selected signal edge appearing at B input (which completes the measurement) in a range from 200 nanoseconds to 10 seconds. In addition to single interval measurements, an average over 10, 100 or 1000 intervals may be selected.

EVENT COUNT. Counts up to 99,999,999 events (each event is marked by the appearance of the selected edge of a signal at the A input) appearing at the A input at up to 10 MHz. The "Run" pushbutton allows counting to begin. When the "Hold" pushbutton is pressed, the display freezes while counting continues; pressing "Run" returns the display to following the accumulated total counts. The "Reset" pushbutton returns the count to zero.

The Model 5001 features a bright 8-digit 0.43-inch (11 mm) LED display. Decimal points are positioned to give frequency measurements in KiloHertz, time measurements in microseconds. Discrete LEDs show Overflow (count exceeds 99,999,999) and Gate-Open conditions.

Applications for the Model 5001 include tachometry, process control, production line counting, flow metering, stroboscopy, chronometry, signal analysis and more.



CONTROL LOCATIONS AND DESCRIPTIONS

Delay

Variable control introduces 75 millisecond to 7.5 second delay between end of one measurement cycle and start of the next, during which time the display holds the result of the last measurement cycle. **Hold** detent position permits one full measurement cycle to occur, then postpones the next cycle indefinitely, maintaining the results of the first cycle on the display indefinitely.

Power

Push in for *on,* push again to release to *off.*

Frequency

Selects *frequency counter* mode of operation, counts selected signal edges appearing at A input (maximum 10 MHz) during selected gate interval. In this mode, the seventh, eighth, ninth and tenth pushbuttons (from left) select gate intervals of .01, 0.1, 1.0 or 10 seconds, respectively. Also, when the *Frequency* pushbutton is pressed in at the same time as the **Period** pushbutton, the 5001 enters a **Self-Test** mode: display indicates 10000.0, 10000.00, 10000.000 or *(Overflow)* 0000.0000, depending on which of seventh, eighth, ninth and tenth pushbuttons, respectively, is selected.

Period

Selects *period measurement* mode of operation, measures time between successive appearances of selected signal edge at A input in the range 400 nsec to 10 sec. In this mode, the seventh pushbutton selects a single-cycle measurement; the eighth, ninth and tenth pushbuttons select averaged measurements over 10, 100 or 1000 cycles, respectively. Also provides **Self-Test** function when used in conjunction with **Frequency** pushbutton (q.v.).

Ratio

Selects *frequency ratio* (F_A/F_B) mode of operation, counts selected signal edges appearing at A input (maximum 10 MHz) after the first and before the $n + 1$ selected edge appearing at the B input (maximum 2 MHz, where n is selected to be 1, 10, 100 or 1000 by pressing the seventh, eighth, ninth of tenth pushbutton, respectively). Readings are expressed as single-cycle averages whether taken over 1, 10, 100 or 1000 cycles of B.

Time

Selects *time interval* mode of operation, measurement cycle begins with first selected edge at A, ends with next selected edge at B for single interval measurement; cycle is repeated 10, 100 or 1000 times and average for all cycles displayed for multiple time interval average measurements.

Count

Selects *event counter* mode of operation, counts number of selected signal edges appearing at A input (maximum signal frequency 10 MHz) to a maximum of 99,999,999 events. In this mode, the functions of the seventh, eighth and ninth pushbuttons are as follows:

Run. In the *event counter* mode of operation, the seventh pushbutton must be pressed before any event (selected A input signal edge) will be counted. Also, returns display to running count if **Hold** pushbutton has been pressed.

Hold. In the *event counter* mode of operation, the eighth pushbutton provides a *display hold* function. (Although not marked, the tenth pushbutton also provides this function). This freezes the count appearing on the display, but the running count continues to accumulate. The display can be returned to the running count by pressing the **Run** pushbutton.

Reset. In the *event counter* mode of operation, the ninth pushbutton provides a *counter reset* function which resets both the counter and the display to zero (display indicates righthand decimal point only since all eight leading zeroes are blanked).

.01/1/Run

Depending on the selected mode, this pushbutton either selects a .01 second gate time (*frequency counter* mode), a single-cycle measurement (*period measurement, frequency ratio* and *time interval* modes) or provides the *run* function in the *event counter* mode.

.1/10/Hold

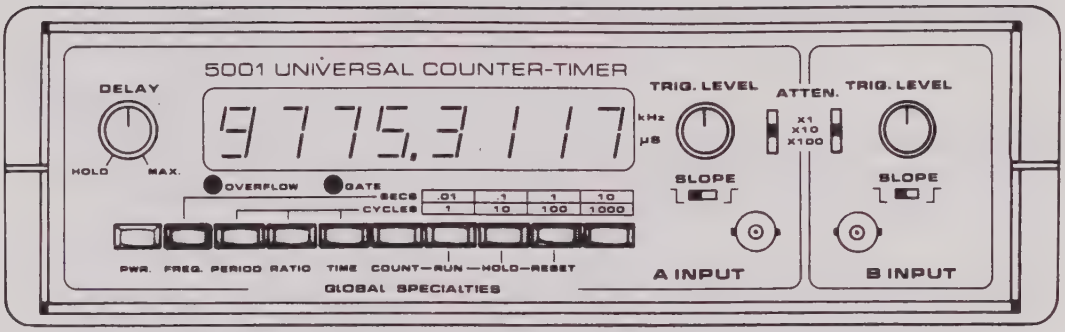
Depending on the selected mode, this pushbutton either selects a 0.1 second gate time (*frequency counter* mode), a measurement averaged over 10 cycles (*period measurement, frequency ratio* and *time interval* modes) or provides the *hold* function in the *event counter* mode.

1/100/Reset

Depending on the selected mode, this pushbutton either selects a 1.0 second gate time (*frequency counter* mode), a measurement averaged over 100 cycles (*period measurement, frequency ratio* and *time interval* modes) or provides the *reset* function in the *event counter* mode.

10/1000

Depending on the selected mode, this pushbutton either selects a 10 second gate time (*frequency counter* mode) or a measurement averaged over 1000 cycles (*period measurement, frequency ratio* and *time interval* modes); although not so marked, also provides *hold* function in *event counter* mode.



Trigger Level

Permits measurement of AC signals superimposed on DC. Also used to select level at which digital signal will be recognized. The range of this control is ±1 Volt with the attenuator in the x1 position, ±10 Volts with the attenuator in the x10 position and ±100 Volts with the attenuator in the x100 position.

Slope

Selects whether count will occur on rising or falling edge of input signal.

Attenuator

Selects x1/x10/x100 attenuation of input signal.

Display

Eight digits. Lead zero blanking. Decimal point formats frequency display in KiloHertz, time display in microseconds, other displays in units.

Overflow

Lights when measurement exceeds 99999999 (ignoring decimal points).

Gate

Lights to indicate *gate open* condition (measurement cycle in progress).

INITIAL INSPECTION AND CHECKOUT PROCEDURE

In order to accomplish the initial inspection of your Model 5001 Universal Counter Timer you will need the following:

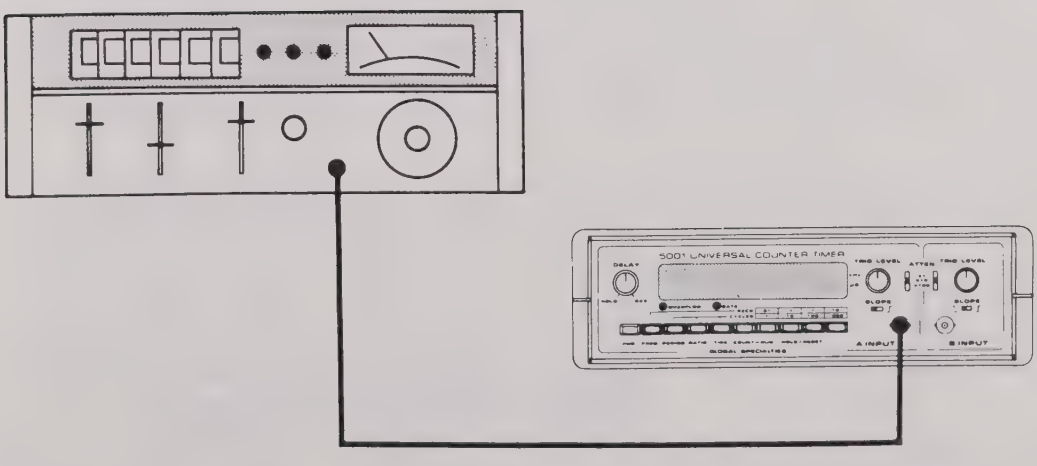
1. A grounded (three-prong) 50/60Hz AC outlet of the correct Voltage.
2. Two signal sources capable of providing signals in the range 10Hz to 10MHz at accurately-known frequencies and at amplitudes in the range 20mV rms to 2V rms.

Procedure

1. Plug the 5001 into the outlet. Turn power *on.* Select the *frequency counter* mode and the *.01 second* gate time. The display should now indicate a single 0 on the right hand side. Turn the *Display/Hold* control to minimum (fully counterclockwise, but *before* detent position).
2. Connect one signal source to the A input. Set its frequency to 1MHz and its amplitude to 1 V_{RMS}. The display should now indicate 1000.0. If it does not, adjust the *Trigger Level* control until the correct reading is obtained.
3. Select in order the *.1 sec, 1 sec* and *10 sec* gate times; you should continue to see readings of 1000, but with increasing accuracy. Note that the *10sec* gate time requires 10 seconds to take a reading.
4. Select the *period measurement* mode and *1 cycle* measurement. The display should indicate a period of 1.0 microsecond. Select in order the *10 cycle, 100 cycle* and *1000 cycle* averages; the reading should not deviate significantly from 1.0 microsecond.
5. Lower the frequency of your signal generator to 1kHz. Display should indicate that the period is 100,000 microseconds.
6. Lower the frequency again to 10Hz. The *1 cycle* and *10 cycle* average will indicate that the period is 100,000 microseconds. For *100 cycle and 1000 cycle* averages, the overflow light will light indicating that the period is too large to be measured.
7. Select the *frequency ratio* mode. Adjust the frequency of the signal source to the A input to 10MHz. Connect the second signal source to the B input, set its output frequency to 1kHz and its amplitude to 1V_{RMS}. Adjust the *Trigger Level* control if necessary to get a correct reading. The display should indicate that the A input signal frequency is 10,000:1 greater than the B input signal frequency. Repeat this measurement for *1 cycle, 10 cycle, 100 cycle* and *1000 cycle* averages. As the number of cycles over which the measurement is averaged increases, the accuracy of the readout also increases.
8. Select the *time interval* mode. Connect one of the signal generators to both A and B inputs. Set the A input *slope* for the rising edge of the signal, the B input *slope* for the falling edge. Adjust both *Trigger Level* controls to get a reading. The display should now indicate the time during which the signal is *high* in microseconds.
9. To test the *event counter* mode, the following procedure should be used: Press the *Count* pushbutton and the *Reset* pushbutton. Connect a 1MHz signal to the A input. Now press the *Run* pushbutton; the display will begin to count. The second digit from the left should be counting seconds. Press the *Hold* pushbutton; the display will freeze, but the unit will still be counting. Press the *Run* pushbutton to return the display to a running count. Press the *Reset* pushbutton to set the counter to zero and blank the display.

10. Select the *period measurement* mode and any number of cycles. Put a 1KHz signal into the A input. The display should now read 1000.0 microseconds. Turn the *delay* control clockwise, observe the *gate open* light and see that the delay between successive readings increases. Turn the *delay* control fully counterclockwise to the detent position; the display should hold indefinitely. Similarly, if you now change function (for example, measure the frequency), it will again take one reading and hold.

This completes the initial inspection and checkout procedure.



TEST SETUP FOR FREQUENCY, PERIOD AND EVENT COUNTER MODES.

OPERATING INSTRUCTIONS

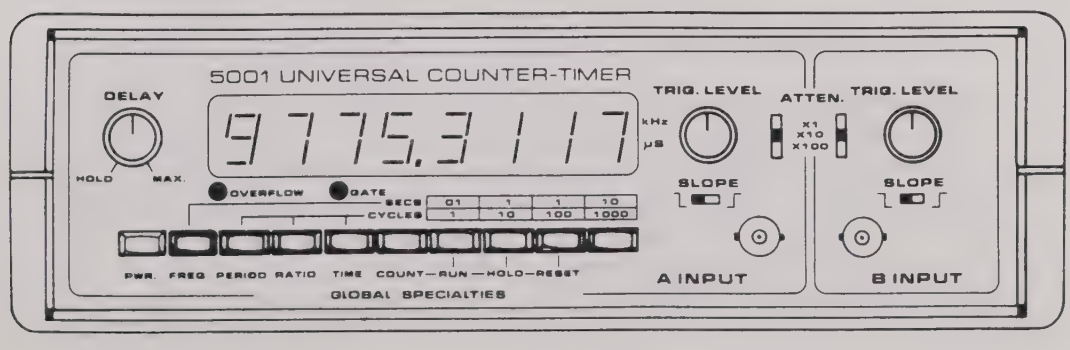
Because of the tremendous functional versatility of the 5001, this description of operating instructions has been modularized. You will find first a description of how to use the several operating modes, then a description of how to adjust the signal conditioning at the inputs, and finally a description of the use of the *Display Hold/Measurement Cycle Delay* feature.

Frequency Counter

1. Press *Power* pushbutton in to turn power on. At least a decimal point and possibly some digits should appear on the display.
2. Set *Delay* control to minimum (fully counterclockwise, but before detent position).
3. Press *Frequency* pushbutton in. *Gate* LED should turn on or flash.
4. Connect input signal to A input. Follow *Signal Conditioning* instructions, below.
5. Select gate time of .01, 0.1, 1.0 or 10 seconds (resolution of 100 Hz, 10 Hz, 1 Hz, 0.1 Hz, respectively). Display indicates frequency in Kilohertz.
6. The *Gate* LED is on during measurement cycles, off between measurement cycles. Actual measurement rate is determined by sum of gate time, display latch housekeeping time and *Display Hold/Measurement Cycle Delay* control setting (see below).
7. The *Overflow* LED is on only during actual counter overflow; in the *frequency counter* mode, this occurs for 10 second gate time with input signal frequencies of 10 MHz or more.

Period Measurement

1. Press *Power* pushbutton in to turn power on. At least a decimal point and possibly some digits should appear on the display.
2. Set *Delay* control to minimum (fully counterclockwise, but before detent position).
3. Press *Period* pushbutton in. *Gate* LED should not turn on or flash.
4. Connect input signal to A input. Follow *Signal Conditioning* instructions, below.
5. Select whether measurement will be taken every cycle or averaged over 10, 100 or 1000 cycles (resolution of 100 nsec, 10 nsec, 1 nsec, 100 psec, respectively). Display indicates period in microseconds.
6. The *Gate* LED is on during measurement cycles, off between measurement cycles. Actual measurement rate is determined by the sum of the total period of the selected number of input signal cycles, display latch house-



keeping time and *Display Hold/Measurement Cycle Delay* control setting (see below).

7. The *Overflow* LED is on for periods greater than 10 seconds, 1 second, 100 msec and 10 msec for 1, 10, 100 and 1000 cycle averages, respectively.

Frequency Ratio

1. Press *Power* pushbutton in to turn power on. At least a decimal point and possibly some digits should appear on the display.
2. Set *Delay* control to minimum (fully counterclockwise, and before detent position).
3. Press *Ratio* pushbutton in. *Gate* LED should not turn on to flash.
4. Connect input signals to A, B inputs. Follow *Signal Conditioning* instructions, below.
5. Select whether measurement will be averaged over 1, 10, 100 or 1000 cycles at B (resolution of 1, .1, .01, .001, respectively). Display indicates number of cycles appearing at A during one cycle at B.
6. The *Gate* LED is on during measurement cycles, off between measurement cycles. Measurement cycle begins with first selected edge at B, ends with 1st, 10th, 100th or 1000th following selected edge at B. Actual measurement rate is determined by the sum of the measurement cycle, display latch housekeeping time and *Display Hold/Measurement Cycle Delay* control setting (see below).
7. The *Overflow* LED is on for ratios greater than 10^8:1, 10^7:1, 10^6:1 or 10^5:1 for 1, 10, 100 or 1000 cycle averages, respectively.

Time Interval

1. Press *Power* pushbutton in to turn power on. At least a decimal point and possibly some digits should appear on the display.
2. Press *Time* pushbutton in. Gate LED should not turn on or flash.
3. Connect input signals to A, B Inputs. Follow signal conditioning instructions below.
4. Select whether measurement will be averaged over 1, 10, 100 or 1000 intervals (resolution of 100 nsec, 10 nsec, 1 nsec, 100 psec respectively). Display indicates time in microseconds.
5. Press *Reset* button in.
6. For single events, press the *Run* button in, (1 cycle) (See steps 7-9.)
7. Turn *Delay* control fully counterclockwise to hold position until click is heard.
8. Rotate *Delay* control clockwise out of the hold position until click is heard. The *Gate* LED should be on and now the 5001 is primed and ready for its first pulse.
9. When the pulse comes through, the 5001 will measure and display the time interval immediately.
10. For multiple average of time interval, it is not necessary to prime the 5001. Ignore steps 7 and 8. Simple set *Delay* control to minimum (fully counterclockwise, but before detent position).
11. The *Gate* LED is on during measurement cycles, off between measurement cycles. Measurement cycle begins with first selected edge at A, ends with 1st, 10th, 100th or 1000th selected edge at B. Actual measurement rate is determined by sum of the measurement cycle, display latch housekeeping time and display hold/measurement cycle delay control setting (see below).
12. The *Overflow* LED is on for intervals greater than 10 seconds, 1 second, 100 msec and 10 msec, respectively for 1, 10, 100, 1000 interval ranges.

Event Counter

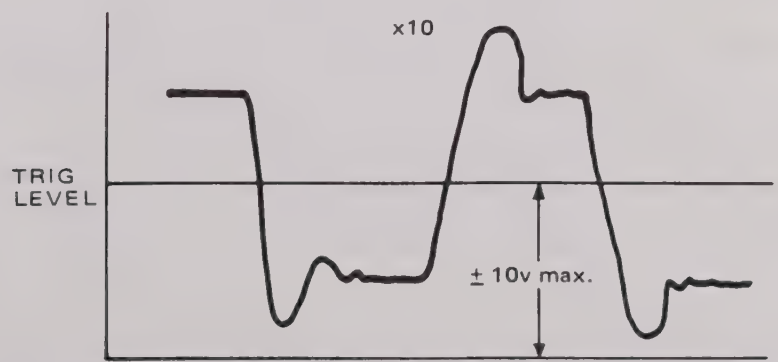
1. Press *Power* pushbutton in to turn power on. At least a decimal point and possibly some digits should appear on the display.
2. Set *Delay* control to minimum (fully counterclockwise, but before detent position).
3. Press *Count* pushbutton in. *Gate* LED should turn on unless *Reset* pushbutton is pressed in.
4. Connect input signal to A input. Follow *Signal Conditioning* instructions, below.
5. Press *Reset* pushbutton in. All digits on the display should blank, leaving only the rightmost decimal point illuminated. This also clears the internal accumulator, setting the running count to zero.
6. When prepared to begin counting events, press *Run* pushbutton in. Display will follow running count to a maximum count of 99,999,999; additional events will continue count with *Overflow* LED on.
7. To freeze display while running count of input events continues in accumulator, press *Hold* pushbutton in. To again display running count, press *Run* pushbutton in. If accumulator reaches count of 100,000,000 or more, *Overflow* LED will not turn on with the Hold pushbutton pressed in.
8. To start a new count, return to step 5.

Signal Conditioning

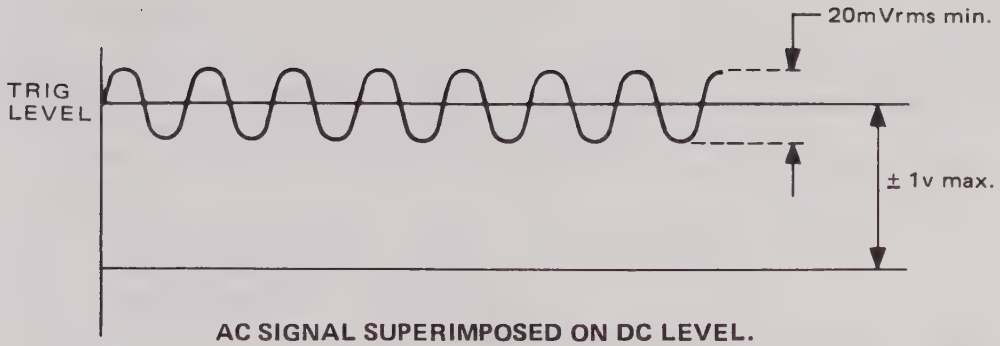
Full signal conditioning at both A and B inputs is a unique and invaluable feature of the Model 5001. To take full advantage of it, follow these guidelines.

Attenuator

1. Determine Voltage level of signal being applied to each input.
2. For input signals greater than 2 Volts (RMS), set *Attenuator* to *x100* position.
3. For input signals between 0.5 and 2.5 Volts (RMS), select the *x10* position of the *Attenuator.*
4. For input signals less than 1 Volt (RMS), set the *Attenuator* to *x1* position.
5. Note that the above ranges overlap. Note also that the *Trigger Level* control range is affected by the *Attenuator* setting (see below). Weight your decision on which *Attenuator* setting to use with the interaction of these controls and the requirements of your particular input signal.



NOISE ON SIGNAL SUGGESTS USE OF MONOSTABLE OR PRECISE TRIGGER LEVEL.



AC SIGNAL SUPERIMPOSED ON DC LEVEL.

Trigger Level

This control is used to permit measurement of AC signals superimposed on DC levels, and to select Voltage thresholds at which switching will occur for digital signals. The range of this control is as follows:

1. With *Attenuator* in *x1* position: ±1 Volt
2. With *Attenuator* in *x10* position: ±10 Volts
3. With *Attenuator* in *x100* position: ±100 Volts

Note that problems may arise with DC-coupled signals if the DC Voltage level is unstable; this may be avoided by placing a capacitor in series with the input.

Slope Selector

Selects whether *rising* or *falling* edge of input signal will be recognized by counting, getting circuits. For *period measurement* mode, it is especially important to choose the edge with less noise on its for best results.

1. Determine whether *rising* or *falling* edge (or transition) is to be selected.
2. To select *falling* edge, slide *Slope* switch to left.
3. To select *rising* edge, slide *Slope* switch to right.

Display Hold/Measurement Cycle Delay

There are many applications for the Model 5001 Universal Counter-Timer in which, unless provision were made to solve the problem, measurement could be made and displayed at a rate much too fast to read or follow. For this reason, a special delay circuit has been incorporated which, at the end of each measurement cycle, delays the start of the next cycle by 0.075 to 7.5 seconds. During this time, the results of the measurement cycle remain displayed. This delay is user-adjustable through the front-panel *Delay* control.

Also, a detent position has been provided which permits one measurement cycle to be completed, then delays the start of the next indefinitely.

1. Always begin each measurement with the *Delay* control set to minimum. This is the counterclockwise position just before the detent position. The detent, or "click" position is labelled *Hold*).
2. Rotate the control clockwise to increase delay, counterclockwise to decrease. Maximum delay of 7.5 seconds is with control rotated fully clockwise to *Max* position.
3. Rotating control fully counterclockwise into detent (click) position, labelled *Hold,* permits one measurement cycle to be completed, displays its results indefinitely, and delays the start of the next measurement cycle indefinitely. This is especially useful for unattended testing, as when determining period of occasional or spurious transient event.

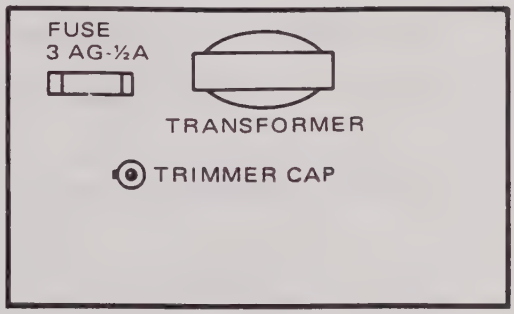
Fuse Replacement

The Model 5001 Universal Counter-Timer uses one fuse, type 3AG, ½ Amp, 250 Volt. This fuse is located inside the case, clip-mounted to the printed circuit board toward the rear of the case, near the power cord.

If replacement of this fuse becomes necessary, the user is advised to follow this procedure:

1. Disconnect anything plugged into either the A or B input.
2. Make certain the *Power* switch is *off.*
3. Disconnect the power cord at the AC outlet.
4. Open the case, following the instructions under *Case Disassembly* (below) completely.
5. Use a non-conductive fuse handling tool to safely remove the old fuse, and to replace it with a new one of equal size and rating.
6. Close the case, following the instructions under *Case Reassembly* (below) completely.
7. Reattach the power cord to the AC outlet.
8. The 5001 is again ready for use.

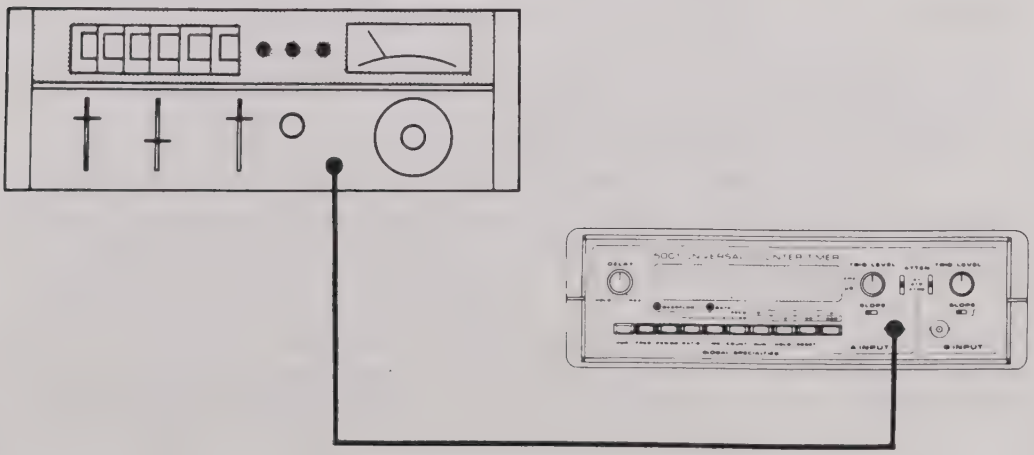
FUSE LOCATION



Recalibration

Your Model 5001 Universal Counter-Timer was calibrated at the factory following a burn-in cycle just previous to shipment; it is warranteed to meet or exceed its published specifications. If at any time the calibration of the unit becomes suspect, you are encouraged to return it to us (see *Factory Service and Repair*). Should you decide to recalibrate the 5001 yourself, follow this procedure:

1. You will need a precise source of 10 MHz signal, preferably at 200 mV to 2.0 Volts RMS and with no DC offset. The accuracy of this signal and precision of this generator limit the validity of your calibration.
2. Remove any connections from both the A and B inputs.



3. Make certain the *Power* switch is *off.*
4. Disconnect the power cord at the AC outlet.
5. Open the case, following the procedure under *Case Disassembly* (below) completely.
6. Locate the crystal oscillator trimmer capacitor.
7. In the following steps, you will be working with power on and circuitry exposed.

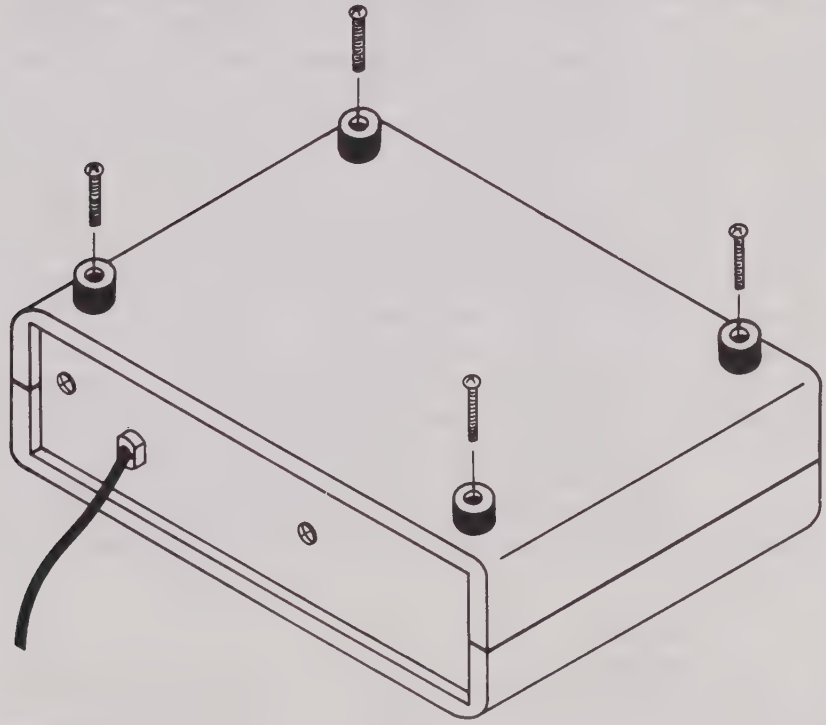
> **WARNING!**
> Potentially dangerous or lethal Voltages are present when power is applied to this instrument with circuitry exposed. Use extreme caution. Avoid all contact with the circuit board, exposed components and exposed wiring.

8. Turn on your precision signal source and connect it to the A input of the 5001.
9. Press the *Power* pushbutton of the 5001 in, turning power *on.*
10. Press in the *Frequency* pushbutton, selecting the *frequency counter* mode.
11. Set the *Delay* control to minimum.
12. Select a gate time of .01 seconds.
13. Allow both your signal generator and the Model 5001 to operate with power *on* for at least one hour.
14. Observe the display on the 5001. If it reads 9999.9 or 10000.0 or 10000.1 proceed to step 18.
15. Adjust *Attenuator, Slope* and *Trigger Level* controls (see *Operating Instructions*) for your input signal. If the display now reads 9999.9, 10000.0 or 10000.1, proceed to step 18.
16. Locate the timebase oscillator crystal *frequency trimmer* capacitor. It is on the printed circuit board, to the left of and slightly forward of the power transformer and adjacent to the crystal.
17. Using a nonconductive tuning wand at least three inches long, adjust the trimmer until the display reads 10000.0.
18. Select a gate time of 0.1 second.
19. Observe the display on the 5001. If it reads 9999.99, 10000.00 or 10000.01, proceed to step 21.
20. Use the tuning wand (see steps 16 and 17) to adjust the trimmer for a display of 10000.00.
21. Select a gate time of 1.0 second.
22. Observe the display on the 5001. If it reads 9999.999, 10000.000 or 10000.001, proceed to step 24.
23. Use the tuning wand (see steps 16 and 17) to adjust the trimmer for a display of 10000.000
24. Select a gate time of 10 seconds; note that you must now wait 10 seconds for the display to update.
25. If the display on the 5001 reads 0000.0000 with the *Overflow* LED lighted, or flickers between this reading and 0000.0001 with the *Overflow* LED lighted, or flickers between 0000.0000 with the *Overflow* LED lighted and 9999.9999 with the *Overflow* LED not lighted, proceed to step 27.
26. Use a tuning wand (see steps 16 and 17) to adjust the trimmer for a display of 0000.0000 with the *Overflow* LED lighted.
27. Wait one hour. If the display has not changed, continue to step 28; if the display has changed, return to step 23.
28. Press the *Power* pushbutton on the 5001 in to turn power *off.* Disconnect the power cord from the AC outlet. Disconnect the connection to the A input. Follow the procedure under *Case Reassembly* (below) completely.

Case Disassembly

Follow these steps any time you wish to open the case of this instrument:

1. Remove any signal connections.
2. Disconnect the power cord from the AC outlet.
3. Turn the instrument upside down (feet facing up).
4. Remove the Phillips-head screw completely from the center recess of each of the four feet.
5. Keeping the top and bottom case halves together with light pressure, carefully reinvert the case so it is again upright.
6. Gently slide the upper half of the case straight upward; once clear of the front and rear panels, place it to one side.
7. The component side of the printed circuit board should now be visible, secured to the bottom half of the case and to both front and rear panels.



Case Reassembly

Follow these steps to reassemble this instrument:

1. Make sure no tools or debris remain inside the case, that all signal connections are removed, and that the printed circuit board and front and rear panels are securely in place.
2. With the bottom half of the case upright, gently slide the upper case half straight down into position atop the lower case half; make sure the front and rear panels are in position in the molded case panel grooves. The top and bottom case halves mate when the beveled edges face forward.
3. Once the top case half is in place, keep the case halves together, in position, with light pressure as you invert the instrument, placing it upside down (feet up).
4. Make sure all four feet are positioned directly over the holes in the case bottom.
5. Reinsert each of the four Phillips-head screws through the center hole in the recessed area of each foot and through the corresponding mounting holes in the case bottom into the threaded mounting posts molded into the upper case half.
6. Tighten all four screws, being careful not to overtighten.
7. Reinvert the instrument to its upright position.
8. Reconnect the power cord to the AC outlet. The instrument is again ready for use.

FUNCTIONAL DESCRIPTION

The heart of the Model 5001 Universal Counter-Timer is a fully integrated LSI Universal Counter and LED display driver circuit, the Intersil ICM7226. Global Specialties has increased the utility of this extremely capable IC with the addition of a number of support circuits and features, as well as handsome packaging in a full-feature professional instrument.

The ICM 7226 has been designed to function as a frequency counter, a period counter, a frequency (F_A/F_B) ratio gating counter, an interval timing counter and an accumulating event counter. With a 10MHz crystal oscillator, resolution in the nanosecond and fractional Hertz range is achievable. Gating, reset, hold and storage signals are available to increase operational flexibility.

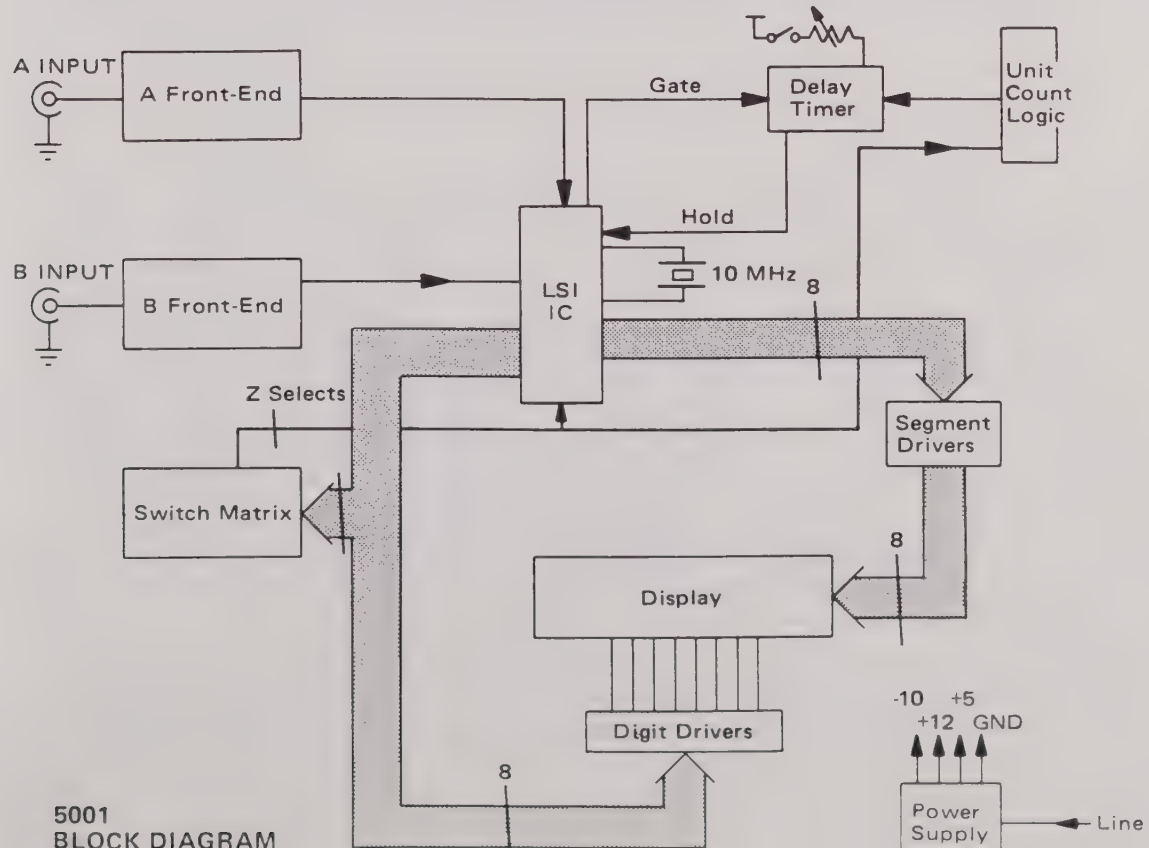
The 5001 provides identical input signal processing on both inputs to fully condition signals for optimum operation of the ICM 7226. Selectable attenuation, slope selection, overload protection, trigger level DC offset adjustment and buffering are incorporated in both channels. Both input preamplifiers are designed to handle signal frequencies up to 35 MHz; limitations of the ICM 7226, however, restrict operation to 10 MHz in the A channel, 2 MHz in B.

The mode, function and range control switch matrix, in addition to formatting the operation of the ICM 7226, provides for automatic clearing and resetting of the counters and the *Display Hold/Measurement Cycle Delay* timer whenever the selected mode changes. This also occurs when power is first turned on.

The *Display Hold/Measurement Cycle Delay* timer provides a user-variable delay in the ICM 7226 *Reset* output before it reaches the IC's *Hold* input.

Global Specialties has incorporated discrete transistor drivers on every segment and digit display line to permit higher drive levels, and thereby a higher brightness display. Eight 0.43-inch digits are included in the 5001 display, in addition to discrete LED indicators for counter overflow and gate activity.

Four separate regulators are used in the 5001 power supply to assure optimum isolation between digital circuitry and input channel amplifier stages.



5001
BLOCK DIAGRAM

CIRCUIT DESCRIPTION

Refer to the block diagram and schematic diagram of the Model 5001 during this discussion of circuit operation.

Input signals at the A and B inputs are connected directly to three-position x1/x10/x100 attenuators (R1, R2, R3 and S16 at A; R13, R14, R15 and S17 at B). Input protection is provided by 100 Ohm series resistors (R4, R16) and diodes D5-8.

Signals are then buffered by JFET source follower preamplifiers Q1 and Q3; optimum biasing of these transistors is assured through the use of constant current sources Q2 and Q4.

Signals then reach Schmitt triggers A1 and A2, where they are compared to levels set by *Trigger Level* controls VR1 and VR2 through Voltage followers in dual amplifier A3. The Schmitt trigger incorporates approximately 20 mV of hysteresis to assure clean transitions even with some noise on the signal.

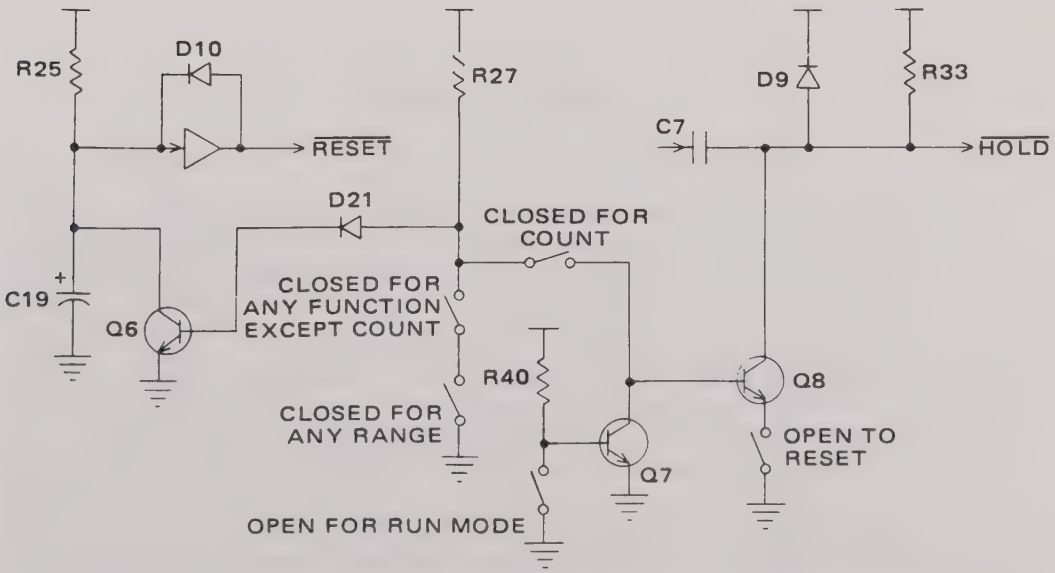
Exclusive OR gates (on U2) in conjunction with *Slope* switches S14 and S15 determine whether rising or falling edges will be counted.

Note that the entire preamplifier circuit for both preamplifiers is designed to work with signal frequencies up to 35 MHz; internal limitations on the LSI counter IC, however, limit A channel response to 10 MHz, B channel to 2 MHz.

LSI IC U1 is an Intersil ICM7726B, which executes all counting, gating housekeeping and display drive signal chores for each Universal Counter-Timer basic function. While no detailed accounting of its operation will be attempted here, highlights follow.

A *measurement in progress* output at pin 3 turns on *Gate Open* LED D20 through transistor Q5.

Function, range and control inputs are time multiplexed onto the display digit drive lines. Selector pushbutton switchbank S2 through S10 provides appropriate codes to U1 through switching in the "A" bank; the "B" bank performs other special functions. For *Frequency, Period, Interval, Ratio* and *Count* mode selectors S2-6, a signal is sent to transistor Q6 any time a new mode is selected. This is combined with a power-on signal at a third U2 exclusive OR gate to generate a reset for U1 and for *Delay* timer A8.



DETAIL FROM SCHEMATIC SHOWS COORDINATION OF RESET MODES.

This same function is accomplished slightly differently in the *event counter* mode. Here, the base of Q6 is not grounded directly through the "B" switchbank, as for other functions, but instead via the base-emitter junction of Q8; the emitter of Q8 is connected to ground in every case except when the *Reset* pushbutton is selected in the *event counter* mode. In this case a reset will occur and Q8 will turn off, allowing the input of A8 to swing high. When the *Run* pushbutton is selected, ground will be disconnected from the base of Q7, which will then be biased on by R40; this will turn Q8 off, releasing A8.

Delay timer A8 is a 555 timer configured as a monostable multivibrator. It drives the *Hold* input of U1, stopping any measurement in progress, resetting the main counter and making the chip ready to initiate a new measurement. Also, the main counter data latches are not updated, so the display continues to show the last complete measurement. But because the input to A8 is the *Reset* output of U1, A8 permits one complete measurement cycle (only) before imposing the *Hold* condition.

U2 buffers the *Reset* output signal from U1, R33 and D9 act as a differentiator.

Delay control VR5 (logarithmic) varies the monostable pulse width at the output of A8 from 75 msec to 7.5 seconds, switch S11 extends it indefinitely.

Transistors Q9-24 buffer both digit and segment display drive lines, permitting higher driving currents for optimum display brightness. *Overflow* LED D11 is multiplexed in place of the most significant digit decimal point.

The power supply makes liberal use of integrated three-terminal regulators. Note that power to the input channel preamplifiers is fully isolated from power to the digital circuit sections in order to minimize spurious coupling. A6 and A7 are cascaded to provide −5VDC and −10VDC using two 5 Volt negative regulators. A3 supplies +5VDC to the logic circuitry. A4 is floated to provide a clean +10 VDC supply using a 5 VDC regulator; this feeds the front end circuitry.

R42 prevents ground loops possible through connection of the 5001 to other equipment. The shell of one BNC input connector should always be electrically connected to the ground of the circuit supplying the input signal.

APPLICATIONS

Frequency Counter

Always measure oscillator frequencies after at least one stage of buffering; measurements taken at the oscillator components themselves can pull the oscillator frequency. When this is unavoidable, using a x10 oscilloscope probe connected to the 5001 A input will minimize circuit loading, reducing this frequency shift.

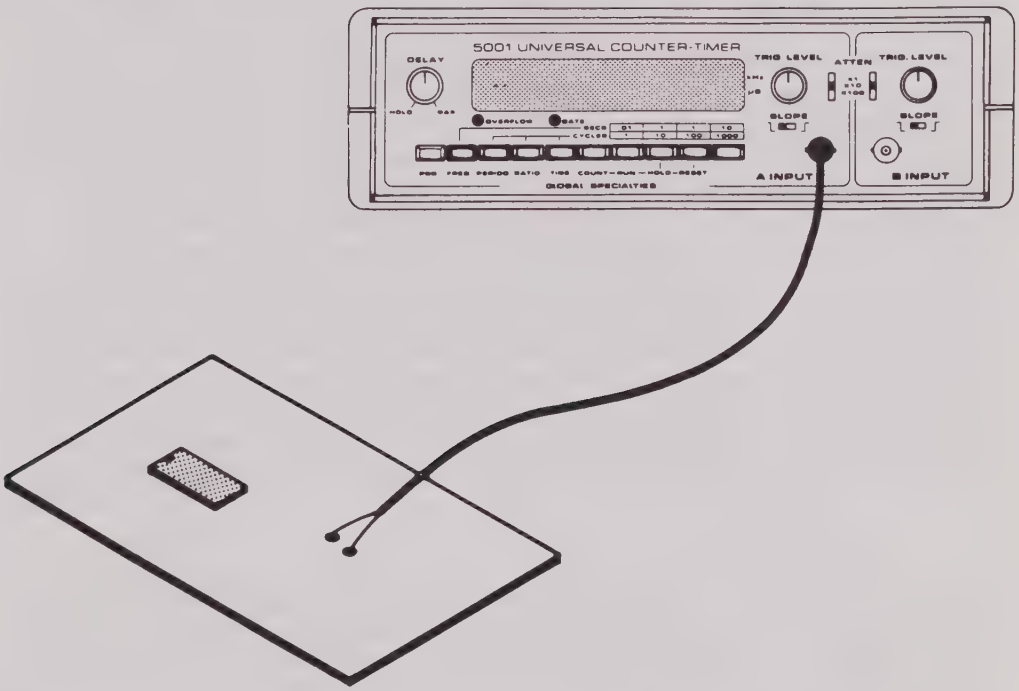
Certain critical applications may require that the Model 5001 input impedance be identical to circuit impedance, for example, a 50, 75 or 300 Ohm termination may be required to properly load the circuit under test. Since both 5001 inputs are high impedance, this termination may be applied at the 5001 input directly.

When measuring transmitter and other radiated field frequencies, a short piece of wire or telescopic antenna connected directly to the 5001 input may provide adequate coupling for a reliable reading. **DO NOT ATTEMPT TO CONNECT THE 5001 INPUT IN PLACE OF THE TRANSMITTER ANTENNA OR ANYWHERE DIRECTLY IN THE TRANSMISSION LINE.**

To measure a frequency which is only available for a short time, set the *Delay* control to its *Hold* (detent, fully counterclockwise) position, press in the *Frequency* pushbutton and select a gate time of 0.1, 1.0 or 10 (but not .01) seconds. Disregard the display at this point. As soon as the signal is available, press in the .01 second gate time pushbutton. The signal then only need remain valid for 10 msec; the 5001 will complete one measurement cycle in that time and will display the results of that measurement indefinitely.

For fast, accurate measurements of low frequencies, use the *period measurement* mode and calculate the frequency as the reciprocal of period:

$$\text{Frequency (MegaHertz)} = \frac{1}{\text{Period (microseconds)}}$$

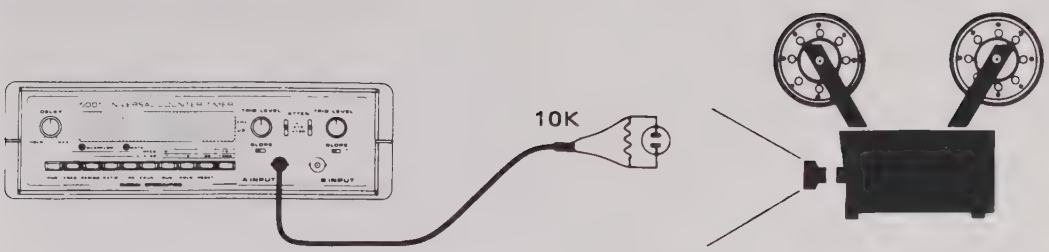


Measuring microprocessor clock frequency: Locate the processor's buffered clock output. Assuming the signal is at TTL levels, set the 5001 A input *Attenuator* to *x10,* set the *Trigger Level* control to +2 Volts (approximately the one o'clock position), and connect clock and ground directly to the 5001 A input connector. Proceed as detailed under *Operating Instructions.*

Period Measurement

The accuracy of this measurement is very dependent on the amount of noise present on the input signal, even when this noise is below the 5001's 3 mV maximum noise threshold. To substantially reduce this dependency, you can average over a larger number of cycles, increase the input amplitude of the waveform, and/or select the steeper edge of the waveform as the significant edge.

Period or *multiple period average measurements* yield much quicker and more accurate results than *frequency* measurements for low frequency phenomena. For example, it would take 10 seconds to provide 0.1 Hz resolution in determining the frequency of a 110.4 Hz (0.1104 KHz) signal in the *Frequency counter* mode; in the *period measurement* mode, a 100-cycle average of 9057.971 microseconds is available in less than one second. If the period were instead to be measured as 9057.946 microseconds, the frequency could be calculated as 110.4003 Hz, yielding an additional three accurate digits.



PHOTOVOLTAIC CELL
FOR CADMIUM SULPHIDE CELL OR
PHOTOTRANSISTOR, USE CIRCUIT ON PAGE 25

Measuring the speed of a motion picture (movie) projector: Like many phenomena, the speed of a motion picture projector may be measured indirectly using the 5001 more simply, more conveniently and more accurately than through direct measurements of mechanical motion. In the case of a motion picture projector, the variable of interest is frame rate in frames per second. Nominally, most projectors run at either 16 or 24 frames per second; in television film chains, every fifth frame is projected twice, converting nominal 24 frame per second motion pictures to nominal (standard) 30 frame per second video rates. Accurate framing of video picture information within sync requires that projector speeds be especially accurate. The 5001 permits accurate measurement of these low frequencies through reciprocal calculation of period, as measured by leading edges of photosensitive transducer outputs in response to each projected frame. A photoVoltaic cell may be connected directly to the 5001 input, but response of these is usually slower than that of other photodetectors. A photodiode or phototransistor can be used with the generalized input sensor conditioning circuit shown. With no film in the projector, and both motor and light turned on, place the sensor directly in front of the lens. Some degree of optical filtering, limiting or shadowing may be desired, depending on specifics of the detector.

Time Interval

Unlike measurements of *multiple period averages, multiple time interval average measurements* accumulate the total errors occurring in all measured intervals; this implies both that some jitter is inevitable when averaging multiple intervals, increasing with the averaged number of intervals, and that variance between single interval measurements is to be expected.

The *time interval* measurement mode provides a highly useful facility for determining pulse parameters. This is done by externally commoning the A and B inputs. Pulse width can then be determined by selecting the rising edge on the A input *Slope* selector and the falling edge on the B input *Slope* selector. Pulse spacing can be determined by selecting the falling edge on the A input *Slope* selector and the rising edge on the B input *Slope* selector. Pulse period can be determined by taking the sum of pulse width and pulse spacing, or by selecting the *period measurement* mode of the 5001. Pulse repetition rate can be determined by taking the reciprocal of pulse period, or by selecting the *frequency counter* mode of the 5001. Duty cycle can be determined mathematically. The following formulae apply:

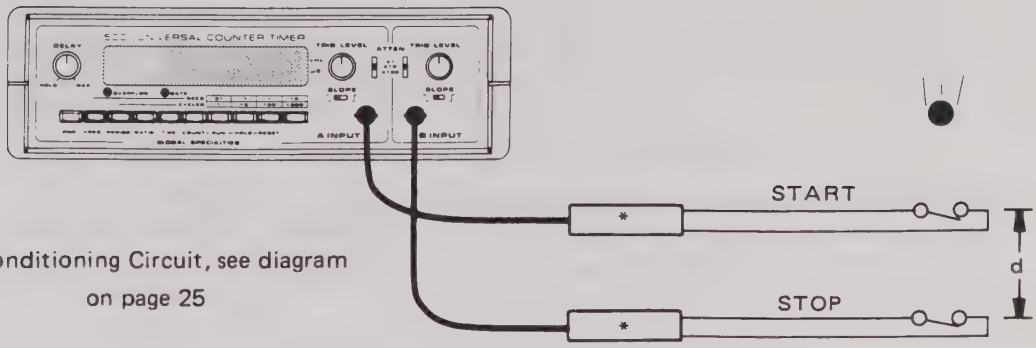
$$\text{Pulse Period} = \text{Pulse Width} + \text{Pulse Spacing}$$

$$\text{Duty Cycle} = \frac{\text{Pulse Width}}{\text{Pulse Period}} = \frac{\text{Pulse Width}}{\text{Pulse Width} + \text{Pulse Spacing}} \times 100\%$$

$$\text{Duty Cycle} = \frac{\text{Pulse Width}}{\text{Pulse Period}} = \text{Pulse Width} \times \text{Pulse Frequency} \times 100\%$$

$$\text{Repetition Rate} = \text{Pulse Frequency} = \frac{1}{\text{Pulse Period}}$$

$$\text{Repetition Rate} = \frac{1}{\text{Pulse Width} + \text{Pulse Spacing}}$$



*Conditioning Circuit, see diagram on page 25

Measuring time of flight and time of fall for ballistic projectiles or falling objects: Time of flight and time of fall may be directly measured by the 5001. The *Display Hold* feature is especially useful because it always permits one and only one measurement cycle, which cannot begin until the appearance of the selected edge at the A input in the *time interval* mode; once the measurement cycle is completed with the appearance of the selected edge at the B input, the display is held indefinitely. Arranging electrical contacts directly in the path of the object is the simplest means of providing appropriate input signals to the 5001, and is acceptable if the force associated with the mass and velocity of the object is large compared to the contact breaking (or making) force required. Note that by using contact opening as the significant event, errors due to contact bounce problems are avoided. Alternatively, photoelectric beam-break detectors may be used, or other methods more convenient to the specific test. Once clean input signals are available, the measurement can be taken 10, 100 or 1000 times using *multiple interval averaging* and the average for all tests displayed; however, beware of contact bounce when switches, for example, are restored between measurements.

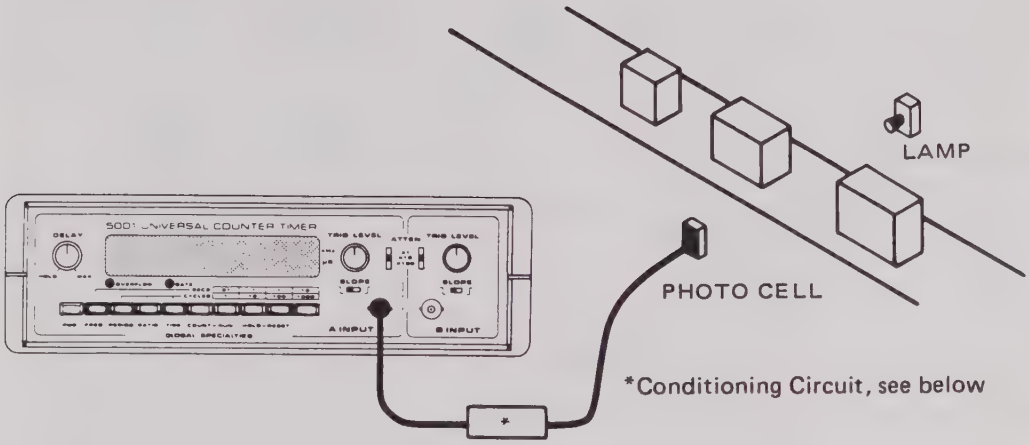
Frequency Ratio

In many cases, the 5001 will be used in conjunction with a signal derived from the metering of a physical phenomenon, such as rotational speed, flow, linear speed, weight, etc. The 5001 can be configured to display measurements in terms of the actual units of interest (for example, RPM, gallons per minute, Kilometers per hour, etc) by taking advantage of the *scaling* (also called *rescaling*) capabilities of the 5001 in the *frequency ratio* mode. In this mode, the 5001 indicates how many selected signal edges appear at the A input between any two subsequent selected signal edges at the B input. In other words, the B input signal gates the A input clock. So instead of displaying frequency measurements in terms cycles per second (Hertz), they are in cycles per B signal period. For example, if an encoding disk on a motor shaft gives 1024 pulses per revolution and the motor is rotating at one revolution per second, the 5001 will see a 1024 Hz signal at the A input. If a 1/1024 second period (1024 Hz) signal appears at the B input, the 5001 display will read 1. To convert to RPM, which means sampling the A input during 60 such periods of 1.1024 second, divide the B input frequency by 60 (1024/60 = 17.07 Hz). Generally, you can determine the frequency to apply to the B input as follows:

1. Determine how many pulses occur per event of interest, converting into the units you wish the event expressed in on the 5001 display. For example, if you know how many pulses are delivered per pint, multiply by 16 to get pulses per gallon.
2. Express 1 second in the time units you wish to use. For example, 1/60 minute, 1000 millisecond, 1/3600 hour.
3. Determine the frequency needed at the B input as

   Frequency at B = (Pulses Per Event) x (Time Units in Seconds)

4. Using the Model 4001 Pulse Generator or Model 2001 Function Generator or equivalent, provide the appropriate signal frequency to the B input. Note that the B input cannot accept a frequency greater than 2 MegaHertz.

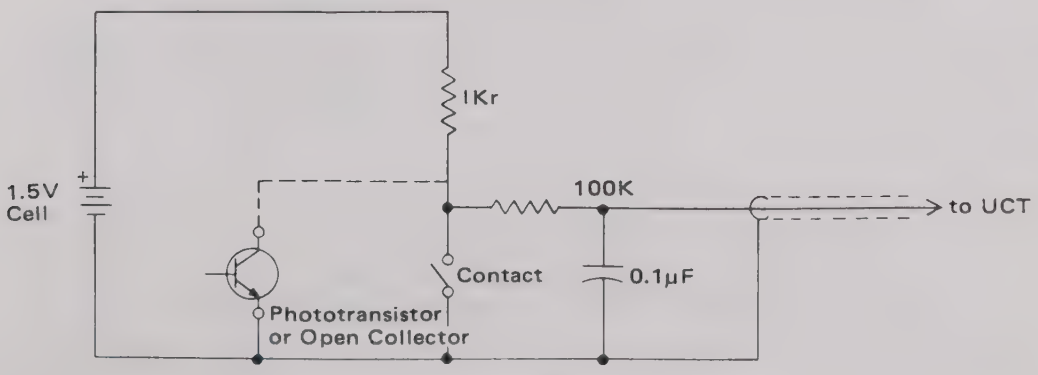


Event Counter

As in other modes of operation, the flexibility of the 5001 input circuitry permits a great many devices to be used as sensors, requiring only very simple interface circuitry (the inputs respond only to Voltages, so simple contact closures and impedance changes require some conditioning).

Additional conditioning of input signals may be required to get accurate counts if the signals include glitches, contact bounce or a great deal of noise. This additional circuitry might be as simple as low pass filtering or monostable contact conditioners. Additionally, purely electronic events could be counted, such as the number of error signals coming from a microprocessor.

Counting items on a conveyor belt: A simple photoelectric beam break arrangement provides a suitable input for the 5001. Assuming each item on the conveyor breaks the beam once and only once, the 5001 can keep a running count on production.



CIRCUIT CONDITIONS INPUT EVENTS.

SERVICE AND WARRANTY INFORMATION

FACTORY SERVICE AND REPAIR

Global Specialties will service and repair this instrument free of charge for a period of one full year, subject to the warranty conditions below.

To obtain a return merchandise authorization (RMA) required for all returns, phone our Customer Service Department for an RMA and all shipping instructions: Tel. 800-572-1028
or write:

GLOBAL SPECIALTIES
70 FULTON TERRACE, BOX 1942
NEW HAVEN, CONNECTICUT 06509
ATTN: CUSTOMER SERVICE DEPARTMENT
1-800-572-1028

CANADIAN
AUTHORIZED SERVICE CENTER
BCS ELECTRONICS, LTD.
980 ALNESS ST.
DOWNSVIEW, ONTARIO M3J 2S2
(416) 661-5585

WARRANTY

Global Specialties warrants this device to be free from defective material or workmanship for a period of one full year from date of original purchase.

Global Specialties under this warranty is limited to repairing the defective device when returned to the factory, shipping charges prepaid, within one full year from date of original purchase.

Units returned to Global Specialties that have been subject to abuse, misuse, damage or accident, or have been connected, installed or adjusted contrary to the instructions furnished by Global Specialties, or that have been repaired by unauthorized persons will not be covered by this warranty.

Global Specialties reserves the right to discontinue models, change specifications, price or design of this device at any time without notice and without incurring any obligation whatsoever.

The purchaser agrees to assume all liabilities for any damages and/or bodily injury which may result from the use or misuse of this device by the purchaser, his employees, or agents.

This warranty is in lieu of all other representations or warranties expressed or implied and no agent or representative of Global Specialties is authorized to assume any other obligation in connection with the sale and purchase of this device.

BREADBOARDING SOCKETS LIFETIME GUARANTEE

All Global breadboarding sockets are guaranteed for life. If a socket ever fails to meet your requirements, return it and we will replace it, NO QUESTIONS ASKED.

Specifications subject to change without notice.

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